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THE SCIENCE MUSEUM

By Dr. D. H. FOLLETT, F.Inst.P.

This article is based on an address given to the Institute's Education Group on January 19, 1952

Since 1929 the Science Museum has had on an average over one million visitors every year (excluding the war years), of which around 400,000 annually were children. It must therefore be regarded as a significant element in the education of the general public in scientific matters. It can also make a large contribution to formal education in science, although this depends very largely on the teachers of science, and whether they will make use of the opportunities the Museum offers.

I have no pet theories on scientific education through the medium of museums, and do not intend to attempt any detailed analysis of the potentialities of the Science Museum in this field. I fear that the results would in any case be vitiated by wishful thinking : for what we should like to do in the Museum falls far short of what we are able to achieve with the resources available. I propose therefore to outline the general aims of the Science Museum, to describe what is done towards achieving those aims—giving some special attention to physics, as is only proper—and on the whole rather to leave it to my readers to consider for themselves how it all fits in with their own ideas on the theory and practice of education.

The Science Museum traces its origin back to the Great Exhibition of 1851. What is now the Science Museum was originally part of the South Kensington Museum, which opened in 1857, and it was not until 1909 that the Science collections in that Museum were separated, to form the Science Museum. At about the same time a Departmental Committee under the chairmanship of Sir Hugh Bell was set up to consider its future development. This Committee did its work so well that its recommendations on the purposes the Museum should serve and the way in which those purposes should be achieved remain, broadly speaking, the foundation of the Museum's policy to this day.

The Bell Committee also made recommendations on the nature and extent of the buildings which they thought would be required for the Museum to fulfil its function properly. The failure of the realisation of these recommendations makes sad hearing and provides the explanation, both directly and in its implications, of some of the shortcomings of the Museum. The Bell Committee estimated that exhibition space of 265,000 square feet was needed in 1912 to show the existing collections so as to fulfil adequately the Museum's purposes ; and they called for an ultimate expansion of this to 377,000 sq. ft., in buildings to stretch from Exhibition Road to Queen's Gate. They visualised buildings in three blocks, referred to for convenience as the East, Centre and West Blocks, to replace the then existing buildings, which covered 108,000 sq. ft. The disappointments and frustrations of the succeeding years are summed up in the statement that in 1953, over forty years after the recommendations were made, the East Block alone has been finished, and the Centre Block merely started. In 1953 we shall have about 200,000 sq. ft. of exhibition space—65,000 less than was considered immediately necessary forty years ago. And science has expanded somewhat since then !

Until 1925 the number of visitors to the Museum averaged about half-a-million annually. But then a rapid increase began, and in 1929 over a million visitors came. This increase was no doubt related to the improvement in the setting-out of the collections made possible by the new building—although the East Block was not finished and formally opened until 1928, parts of it had been in use for some years by then—but the credit for this increase in popularity must go to the Director of that period, Sir Henry Lyons, who must be regarded as the founder of the Museum's present fortunes. Sir Henry Lyons was President of the Institute of Physics over the period 1933-35, and in him we have a noteworthy link between the Museum and the Institute. The next Director but one, Dr. Herman Shaw, was also a distinguished founder-Fellow of the Institute, and although this particular link between the Museum and the Institute was broken by his sudden death in 1950 strong ties still remain in the persons of the Chairman of the Advisory Council of the Science Museum,

Lord Halsbury, who is a Fellow of the Institute, and four of the Museum's physicists, who are corporate members of the Institute.

The purposes the Science Museum aims to serve may be best expressed in the terms in which the Advisory Council of the Museum has recently sought to bring up-to-date the similar statement made by the Bell Committee in 1911 : " The Science Museum should bring before the public, in a pleasing and intelligible form, the principles and practice of science as such and of the particular branches of science within the Museum's field, the applications of those sciences to the Arts and Industries, and the total effect upon the life of man. This is to be achieved by the exhibition of scientific instruments, apparatus, machines and any objects or representations that may contribute to those purposes, and also by the provision of information concerning the collections. The maintenance of such collections and provision of information concerning them necessarily involves the preservation of objects illustrative of the history of science and technology, and also such researches as may elucidate their history and significance."

The way in which the Museum sets out to achieve these aims is to present to the public collections of objects, grouped according to subject, each of which, ideally, represents the historical development of that subject, leading up to a balanced display of its present state. This is the ideal ; in practice, we often fall short of it. Some subjects may not lend themselves so readily as do others to this approach ; and perhaps the biggest difficulty is that of adapting the presentation to the space available. The approach to the presentation of a subject within the framework indicated and the method of display adopted necessarily vary with the subject. There are no hard-and-fast rules and the officer in charge of a subject can exercise his own judgment as to the most practicable methods to adopt in giving to the public what he thinks it wants and needs. As the Director said in a recent address to the Science Masters Association : " We gladly put up with some inconsistency of approach in order to gain the human individuality of presentation."

The subjects under which the collections are shown fall broadly into two groups, described, perhaps rather inaccurately, the one as " science," the other as " engineering." The subjects into which those groups are divided are undoubtedly not exactly those which would be chosen if one were starting a Science Museum from the beginning ; but the Museum has developed on the basis of these classifications, some of which may have arisen from expediency rather than logic, and there seems no reason why any change should be made now. There are actually about seventy such subjects : to mention a few at random, we have on the science side astronomy, atomic physics, heat and thermal instruments, terrestrial magnetism, navigation, geodesy and surveying, electricity and magnetism, time measurement, photography and cinematography, organic chemistry and chemical processes ; and on the engineering side aero-engines and accessories, agricultural implements and machinery, cycles, electrical engineering, marine engines and boilers, sailing ships, radio communication. This is perhaps a bewildering assortment of titles, and it is apparent that we are far from the simple and familiar classifications exemplified by the everyday division of physics into heat, light, sound, electricity and magnetism ; but our classifications are workable, and the very fact that they are somewhat remote from the ordinary textbook groupings is conducive to a broadening of outlook from the start.

In addition to all these sections of what may be termed the main collections, there is the well-known Children's Gallery. This was opened in 1931, and its object, to quote the Advisory Council's Report for 1930, is " to illustrate in as simple and attractive a manner as possible the development of applied science and its influence upon material and social progress." It was also intended that it should ultimately comprise also an introduction to the main collections by demonstrating scientific and engineering principles without reference to their historical development. There are a few exhibits on these lines —for example, one demonstrating systems of pulleys, and other devices for lifting (Fig. 1), another demonstrating experiments in vacua, another showing the elementary principles of time measurement—but much more space is needed before either object of the Children's Gallery can be adequately developed. Apart from the exhibits illustrating principles, the emphasis in the Children's Gallery is to show scientific development in its everyday setting. For example, a series of dioramas shows

Figure 1. *Children's Gallery exhibit demonstrating the principles of pulleys and other lifting devices.*

the development of transport through the ages, starting with a representation of primitive man carrying a load on his back and leading up, through the sledge, the roller and the wheeled vehicle to the modern locomotive and motor car, concurrently with the evolution of transport by water and air. But nowhere in the Children's Gallery is there an attempt to show how the locomotive, for example, works—that is left for the main collections to tell.

Going on to consider some of the different methods used in presenting the Museum collections to the public, I mention first the feature for which perhaps the Science Museum is best known, and which appears in every collection in which it is applicable : the working exhibit which the visitor can operate by pressing a button or turning a handle. Such exhibits range from sectioned models of locomotives and marine engines, whose operation is thus demonstrated in the simplest possible way when they are set in motion, through demonstrations of physical phenomena, in the form of reconstructions of historic experiments, to mechanical analogues illustrating the operation

Figure 2. View of Agricultural Gallery exemplifying the use of modern display methods.

of the cyclotron or the structure of the acetylene molecule. In addition to working exhibits there are also many exhibits which are demonstrated by Museum staff at fixed times, or on request. The textiles machinery collection is an outstanding example of a section in which such demonstrations are a feature.

In recent years, much more attention has been given to presenting the collections attractively. Not so very long ago, it was considered that all that was necessary was to arrange the exhibits in neat rows on the floor, or in glass showcases themselves arranged in neat rows, each object with its descriptive label (in two parts, the first giving brief general information for the ordinary visitor, the second more detailed data for the more knowledgeable visitor), each group of objects with its " group " label. It is now recognised, however, that this is not good enough, and more and more attention is being devoted to the presentation of the collections in a more attractive way, using the resources of modern techniques of display. But the process of conversion from the one system to the other can only be very gradual. So far it has been done with three collections only, all on the engineering side (Fig. 2). The most recent is the Mining section, which is laid out around a large central exhibit representing realistically the interior of a coalmine. Such schemes make heavy demands on the Museum's workshop resources, and require a great deal of co-operation from manufacturers and industrial associations outside the Museum ; in this latter respect the science collections are at a disadvantage in comparison with the engineering sections, whose corresponding industries are on so much larger a scale than those relating to pure science.

A method by which the Museum brings current developments before the public, and at the same time ensures that there is always something new to be seen, is the Special Exhibition. Such exhibitions are run in collaboration with an interested outside body and usually mark some special occasion. They normally continue for about three months. A typical example, chosen for mention because it happened that the Institute took the leading part among the three bodies concerned, was the Electron Jubilee Exhibition of 1947, held to mark the fiftieth anniversary of the discovery of the electron. The object of the exhibition was to illustrate the far-reaching developments which stemmed from that discovery. Many working models were produced specially for the exhibition, and some of them have remained permanently in the Museum.

The free use of descriptive labels ensures as far as possible that the collections can be studied by visitors without assistance from the Museum staff, though such assistance can always be obtained on request. There is also a regular service of lectures for those who wish to use it. Two Guide Lecturers are on the staff ; every morning a public lecture is given in one of the galleries, and every afternoon there is one in the Lecture Theatre. The services of the Guide Lecturers may also be booked by school or other parties whenever desired. Scientific films are shown daily in the Children's Gallery cinema, and there are regular weekly film shows in the Lecture Theatre, run in collaboration with the Scientific Film Association. Finally, the officers in charge of the collections reply to enquiries on all manner of scientific and engineering subjects, at every conceivable level of inanity or profundity—but they are becoming very suspicious of enquiries which have any smell of " project " about them ! It should perhaps be mentioned that there is no charge for any of these services.

The physics collections are classified under a number of subject headings, some of which, perhaps, may not be generally regarded as physics at all. We have sections covering the traditional subjects heat, light, sound, electricity and magnetism (though not quite under those names). We have an embryo section on vibrations and wave-motion, and sections on electron physics (including X-rays), and atomic physics. There is a small section devoted to vacuum pumps (shortly to be put on exhibition), and an outstanding section on time measurement. Astronomy and mathematics are grouped with physics, and then we come to certain branches of applied physics, namely, meteorology, geophysics, terrestrial magnetism, geodesy and surveying, navigation and finally geography and oceanography. This may seem an odd selection of subjects, and there are no doubt other branches of applied physics (as distinct from engineering) which might be thought to be equally deserving of representation. But these are the groupings under which the collections have developed over the years. It is impossible to cover all fields ; and perhaps these are as good as any for the purpose of presenting science to the public.

So far there has been no opportunity for any physics section to be re-deployed as a whole making use of modern methods of display, as have three of the engineering sections, but a piecemeal re-display is gradually taking place and some of the sections are becoming more attractive to look at than they were in the old days of austere glass-cases fitted with plain glass shelves. More working models are being introduced, but it is a slow process.

The physics sections probably make little appeal to the general public, and we have no illusions that we can teach it any systematic physics. But those who know something of the subject, however little, and are interested enough to make some effort to understand what we have to show can, we believe, derive much benefit from a study of the collections.

In deciding what working models we should show we deliberately avoid showing experiments which are done in any ordinary physics course. We do not shun demonstrations of elementary physical phenomena ; but when we use them it is usually in the form of reproductions of historic experiments —such as Faraday's induction ring, his magnet-in-solenoid experiment, Oersted's observation of the action of a current in a wire on a magnet. Among other typical working exhibits are a reproduction of Hallwachs's demonstration of the photo-electric effect ; an exhibit in which visitors may themselves measure e/m for the electron by the method used by J. J. Thomson in his classic experiments leading to the discovery of the electron ; an infra-red image-converter ; an exhibit demonstrating the principles of the cathode ray tube ; a Rayleigh disk ; a striking demonstration of the transition of liquid carbon dioxide under pressure to the gaseous state when the temperature is raised above the critical point, and its recondensation when the temperature falls again ; a Geiger counter in operation ; a mechanical analogue of the cyclotron ; and in the time measurement section large models of escapements and a quartz crystal clock. Space forbids extension of this list here ; but it will suffice to show that we have much to show that cannot be seen anywhere else.

The majority of visitors who come to the Museum do so as a form of intelligent recreation, and not in any systematic quest for knowledge, and we think that their needs are reasonably well catered for. We are, however, conscious that the needs of the younger visitors who are still receiving formal education require particular attention, and the Advisory Council of the Science Museum has in fact appointed a committee to consider how their needs should be met. Of these young people, in whom members of the Education Group will naturally be most interested, those who gain the most benefit from a visit are undoubtedly those who come in organised parties under the guidance of an enlightened teacher who has fitted a Museum visit, or a series of visits, into a planned course. We hope to be able to do more to help such teachers to get the most out of their visits. We hope also that the findings of the committee will lead to the development of methods by which we can do much more to help the unaccompanied young visitor—or those who come with a teacher who regards the visit as being no more than a day out. In the meantime, however, I think the Museum is doing useful educational work if it succeeds in stimulating latent scientific interests in those youngsters who have an aptitude for a scientific career and who might otherwise miss it ; or even, by bringing science down to its everyday plane, if it succeeds in correcting some of the fantastic ideas of the scope of science which are disseminated by the crude " science fiction " and " comics " we see so much of nowadays.

PROCEEDINGS OF THE BOARD

The Board met on October 9 and November 18, 1952, the President (Dr. C. Sykes) in the Chair. The following items of business were among those dealt with.

Budget for 1953

The Honorary Treasurer (Dr. S. Whitehead), on behalf of the Finance Committee, submitted the Budget for 1953 which was agreed. The expenditure was estimated at £42,000 (compared with £37,700 the previous year), in addition to £750 allocated to writing off capital expenditure on the House and a further £985 to be paid as premium of a Leasehold Redemption Policy. This policy will provide a sum of £40,000 in 1982 when the lease of the Institute's House expires. Of the £42,000 expenditure, nearly one half (£19,500) will be spent on the production and distribution of the Institute's publications ; about one half of the amount to be spent on salaries, wages and superannuation (£12,500 in total) is also directly attributable to publications.

The total cash income was estimated at £39,600 (compared with £39,100 in the previous year) ; in addition, because of the heavy programme of publications, there will be an estimated increase of £6,000 in the value (at cost) of publications held in stock at the end of the year. The budgetted surplus for the year is £3,600 which would be reduced by the indirect savings referred to above (writing off and Leasehold Redemption premium) to about £1,900. This sum would, it is hoped, be available for transfer to reserve but, although allowance has been made for rising costs, present uncertainties about prices make it possible that the final surplus may be considerably less. Members will remember that one of the reasons why the increased subscription rates were introduced in 1950 was to make possible the building up of the Institute's reserves while also expanding the range of the Institute's work.

Joint Library with the Physical Society.

A report from the Institute's representatives on the Joint Library Committee with the Physical Society was agreed. The representatives had felt that the demand from Institute members for the Joint Library was small and had recommended that the administration of the library be vested solely in the Physical Society and it be renamed "The Physical Society Library." The Board agreed to submit this proposal to the Society and to offer to make a gift of the shelving, books and periodicals at Lowther Gardens which had been provided by the Institute. The Council of the Society has since expressed its appreciation of this proposal and its acceptance of it. The Council will gladly offer the use of the Library to any members of the Institute who occasionally wish to avail themselves of its facilities; the Institute representatives on the Library Committee have been invited to continue to serve in their personal capacities.

Bowen Prizes

The Board has gladly accepted an offer of the Scientific Instrument Manufacturers' Association of Great Britain Ltd., of £50 a year for the next three years from the Bowen Trust Fund. The purpose of the gift is to provide prizes for the best original contributions relating to scientific instruments and their use published in either of the Institute's journals. The late Mr. William Bowen, by whom the Trust Fund was established, was a Fellow of the Institute and Governing Director of Bowen Instrument Co. Ltd., of Leeds.

The following rules have been adopted by the Board to govern the award of prizes :—

(1) Not more than three prizes a year shall be awarded, none of which shall be less than £10 and the total of which shall not exceed £50.

(2) In awarding the prizes, due weight shall be given to each of the following : (i) Originality ; (ii) Scientific value ; (iii) Practical utility to instrument makers and users ; (iv) Presentation, including the standard of presentation of the manuscript.

(3) Members and non-members of The Institute of Physics shall be equally eligible for prizes provided they were not more than 35 years of age on the date of the receipt of the manuscript in the editorial office (and not less than 21 years of age on that date). No member of the Board of The Institute of Physics or of the Prizes or Journals Committees shall be eligible.

(4) No article of which the substance has been previously published shall be eligible.

(5) The Board may withhold the award of prizes if, in its view, no paper of sufficient merit is presented.

(6) The decision of the Board of The Institute of Physics shall be final.

The prize-winners will be recommended to the Board by a Committee consisting of the Chairmen of the Advisory Committees of the *Journal of Scientific Instruments* and of the *British Journal of Applied Physics*, together with one member of the Board and the Editor.

Centenary of the Royal Photographic Society

It was agreed to present a congratulatory address to the Royal Photographic Society on the occasion of its Centenary on January 20, 1953. An inscribed address in the following terms was presented, Dr. J. Topping (*Vice-President*) representing the Institute at the presentation ceremony. Professor E. G. Cox (*Vice-President*) was the Institute's representative at the Centenary Dinner.

The Institute of Physics
presents congratulations to
The Royal Photographic Society

on the occasion of its Centenary Conference. Founded while the Daguerreotype was still flourishing, the Society has fostered this last hundred years the development of the science and art of photography. To-day photography is one of the most effective tools in the equipment of the physicist, its uses ranging from recording far distant universes to photographing the tracks of the particles of sub-atomic size which come to earth as cosmic radiation. The roll of its members and the record of its publications carry the names of eminent physicists from Sir Charles Wheatstone to Sir William Bragg. Not least among the efforts of the Society to assist the development of the technical and scientific uses of photography and the scientific study of the photographic process was the formation, 34 years ago, of the Scientific and Technical Group. Study of the proceedings of this Group reveals substantial progress, to which physicists have made their contribution, and from which physicists in general have derived important benefits.

Representatives

The following members were appointed as Institute representatives in response to invitations from the bodies concerned :

Regional Council for Further Education for the South-West : Professor S. H. Piper.

R. W. Paul Instrument Fund Committee of the Royal Society : Sir Frank Smith.

British Standards Institution Sub-committee on X-ray Film Processing Units : Mr. J. C. Rockley.

"*In physics, as in life, when you have set yourself the right problem the rest is fairly simple.*

"*More projects in applied physics have been stultified by bad English than by bad physics or bad mathematics.*"

SIR ROBERT WATSON-WATT.

MEMBERS OF NOTE

Eric Oswald Hercus, D.Sc.

A New Zealander by birth, Dr. Hercus is now sixty-two years of age. He was educated in Otago and graduated in the University of New Zealand in 1911, obtaining the M.Sc. the following year. In 1913 he joined Professor T. H. Laby at Victoria College, Wellington, and after a year was awarded the Exhibition of 1851 Scholarship for New Zealand. This he held at the University of Cambridge, spending two years on research in the Cavendish Laboratory. After a period of service as a Lieutenant in the Royal Navy, during which he acted as scientific assistant to Admiral Bacon and, later, Admiral Keyes, Dr. Hercus left Cambridge in 1919 to rejoin Professor Laby who had by then moved to the University of Melbourne. For the next few years his principal research was concerned with the measurement of the mechanical equivalent of heat. Heat has remained one of his principal interests although since 1927 he has been largely concerned with the teaching work of the University of Melbourne where he is Associate-Professor of Physics. In 1951 his book "Elements of Thermodynamics and Statistical Mechanics" was published.

In 1949 Dr. Hercus was Honorary Secretary of the Australian National Research Council and represented Australia at the 1951 meeting of the International Union of Physics at Copenhagen. He took the opportunity of spending some months in this country and attended several Institute meetings including the Annual Conference of Honorary Officers of Branches and Groups.

Elected to Associateship of the Institute in 1923 and to Fellowship in 1929, he has been actively connected with the Australian Branch since its foundation. He was Vice-President of the Branch in 1945 and is now its Honorary Secretary. His son G. R. Hercus is an Associate of the Institute and is carrying out research in low temperature physics at the Clarendon Laboratory, Oxford.

George Henry Briggs, D.Sc., Ph.D.

Born in Sydney in 1893, Dr. Briggs graduated in physics at the University of Sydney and in 1916 was appointed a Lecturer in physics in that University. In 1925 he came to this country to carry out research at the Cavendish Laboratory, Cambridge ; shortly after his return to Sydney he was appointed Assistant-Professor of Physics, which post he held until 1939, paying another visit to the Cavendish Laboratory in 1936. In 1939 he visited North America and toured American standardizing laboratories, later coming to England to spend some months at the National Physical Laboratory. On his return to Australia he joined the Australian National Standards Laboratory where he is Chief of the Division of Physics.

Dr. Briggs's personal research at the University of Sydney and at the Cavendish Laboratory was almost wholly in radioactivity and he has had papers published in the *Proceedings of The Royal Society* and other journals. The Division of Physics, which he now directs, is one of the three Divisions constituting the Australian National Standards Laboratory and is responsible for the Commonwealth standards of measurement in heat and light and for the electrical standards of the ohm and the volt. The Division also carries out fundamental research in low temperature physics and solar physics.

During the war Dr. Briggs was a member of the Panel which advised the Australian Government on the manufacture of optical munitions and he was also a member of the war-time Flying Personnel Research Committee of the Royal Australian Air Force. He was awarded the Lyle Medal of the Australian National Research Council in 1941. At the end of the war

Dr. Briggs and Professor M. L. Oliphant were the Scientific Advisers to the Australian Delegate to the United Nations Atomic Energy Commission ; this required Dr. Briggs to spend nine months in America in 1946 and a further six months in 1947, when he was the sole Scientific Adviser to the Australian Delegate.

Dr. Briggs became a Fellow of the Institute in 1928 and has been one of the stalwarts of the Australian Branch of the Institute. He was Honorary Secretary-Treasurer of the Branch from 1944 to 1949 inclusive and then President of the Branch for two years. Despite the serious geographical difficulties, the Branch is active and flourishing, a condition to which Dr. Briggs has made big contributions.

NEWS OF MEMBERS

Fellows

J. N. ALDINGTON has been appointed Managing Director of Siemens Electric Lamps and Supplies Limited, Preston.

T. E. ALLIBONE is now Director of Research of Edison Swan Electric Company Limited with a seat on the Board of the Company. He retains his present post of Director of the Research Laboratory of Associated Electrical Industries Limited.

F. A. BANNISTER has been appointed Keeper of Minerals at the British Museum (Natural History), London.

PROFESSOR WILLIS JACKSON is to succeed Sir Arthur Fleming (*Fellow*) as Director of Research and Education of the Metropolitan-Vickers Electrical Company Limited, Manchester, with a seat on the Board of the Company.

P. A. SHEPPARD has been appointed Professor of Meteorology at the Imperial College of Science and Technology, London.

H. A. STANDING is now with the National Coal Board at the Central Research Establishment, Stoke Orchard, Gloucestershire.

J. TOPPING (*Vice-President*) has been appointed Principal of Guildford Technical College.

L. C. TYTE was awarded the C.B.E. in the New Year Honours List.

S. WHITEHEAD (*Honorary Treasurer*) has been elected a Fellow of Queen Mary College, London.

Associates

G. COATES is now with the British Welding Research Association, Abington, Cambridgeshire.

G. R. FORRESTER has been appointed Chief Laboratory Engineer of the Highways and Bridges Department of the West Riding County Council, Yorkshire.

T. E. GITTOS has been appointed Senior Physics Master at King Edward VI School, Norwich.

I. MADDOCK was awarded the O.B.E. in the New Year Honours List.

L. W. PHIPPS has been appointed a Scientific Officer in the Physics Department of the National Institute for Research in Dairying, Shinfield, Nr. Reading, Berkshire.

R. L. WHITMORE will take up an appointment as Senior Lecturer in the Department of Mining and Fuels of the University of Nottingham, on March 1, 1953.

D. WILLIAMS has been appointed Principal of the School of Art and Science, Frome, Somerset.

P. H. WOOD has been promoted to Group Captain in the Royal Air Force.

Graduates

J. S. M. BOTTERILL has been appointed a Scientific Officer with the Ministry of Supply, Division of Atomic Energy (P), Springfields Factory, Salwick, Nr. Preston, Lancashire.

J. B. EARNSHAW has been appointed a Lecturer in the Department of Physics, University College, Auckland, C.1, New Zealand.

W. W. FOSTER is now with the Herring Industry Board, in the laboratories of the Directorate of Scientific and Industrial Research (Food Investigation Department), Torry, Aberdeen.

F. C. LOVELESS has been appointed Technical Assistant to the Production Manager, 20th Century Electronics Limited, Dunbar Works, West Norwood, London.

D. S. REES has been appointed Technical Assistant in the Electrical Section of the Experimental Department of Armstrong Siddeley Motors Limited, Coventry.

" The virtues to be cultivated by a scientific man are courage, integrity, friendliness and humility : courage, to insist on the value both of ascertainable fact and of its logical consequence ; integrity in experiment, in argument and in criticism ; friendliness to ensure that research, so far as possible, is of concern to every reasonable man anywhere ; and humility to provide a consciousness that one may conceivably be wrong and the other man right."

A. V. HILL.

REVIEWS OF BOOKS

Electromagnetism. By J. Goodier & G. Ghey. (London: John Murray). Pp. viii + 96. Price 6s.

Electrical Units. By E. Bradshaw. (London: Chapman and Hall Ltd.). Pp. 64. Price 9s. 6d.

This first book deals with elementary electromagnetic and electrostatic theory up to university entrance standard and deals, specifically, with problems related to the energy stored in inductances and capacitances. M.K.S. units are used throughout. It commences with a brief discussion of units, continues with a derivation of the magnetising forces of magnetic fields in solenoids, near conductors, etc., and proceeds through a discussion of forces on current carrying conductors and induction (self- and mutual-) to electrostatics. To complete the circuit, a short treatment of standards of measurement and units is then given. A selection of 57 problems is included. The treatment is unusually clear and the book can be recommended.

The second work, on M.K.S. units, will be extremely useful for University students of electrical engineering, who will probably not read it, and for their lecturers, who certainly should. The reviewer, like many other physicists, is inclined to be reactionary in this respect but realises that the M.K.S. system has come to stay and means to grapple courageously with it. Professor Bradshaw's treatment can be thoroughly recommended. There are many excellent tables of units and conversion factors, which form an attractive feature of the book, and an interesting short appendix on field plotting.

J. D. Craggs.

Design for a Brain. By W. Ross Ashby. (London: Chapman and Hall Ltd.). Pp. 260. Price 36s.

To assist the reader the author has prefixed the book with a lucid prefatory summary; the argument of the book is then fully expounded in words; then it is more concisely presented in mathematical form. Briefly, one can say that the book sets out to analyse the nature of learning by examining the way in which mechanisms can be made which are capable of adaptive behaviour; mechanisms which can learn by trial and error to behave in certain ways.

For the general reader, if a physicist, the book is a most instructive example of how a problem should be analysed into phenomena capable of mathematical treatment; which is often the first step to reaching a solution of a problem. Also the book can be recommended as an exercise in thinking on the border-line of our familiar fields of thought.

Without criticising the author's main purpose, there are two steps in the argument which raise queries. The first is in defining a "system" as "any arbitrarily selected set of variables." It is assumed that after we have made our arbitrary selection we can then apply logic or mathematics to the system, other things remaining equal. This is a necessary assumption in physics, and one which we unconsciously make in such tasks as training an animal or a child. But if the "other things" which should remain equal include the major part of any living organism, how much right have we to expect them to remain constant? The author uses the system "A bird chasing a butterfly," "the air in which they move," and "the butterfly" as an example of a system which shows certain regularities.

The seond difficult idea in this work is that of "step functions" which are defined as functions relating two variable such that at some stage a slight change in the first produces a relatively sudden change in the value of the other variable. The class of systems built up of functions some of which are step functions has important properties unknown in systems all of whose variables are related by smoothly or rhythmically varying functions. Not discontinuity, but suddenness, is the criterion of a step-function, and it is admitted that when time is the independent variable (a common case) it is the time-scale which determines suddenness. No explanation is offered of how time scales are selected so that some processes are sudden; nor of how the scale of another variable has to be selected so that its consequence is a "steep" change instead of a gradual one. This seems to the reviewer as oddly arbitrary as the definition of a "system" which might lead to the fallacy that we are safe in ignoring what we cannot measure.

The author proceeds to describe the Homeostat, the first machine which has enough randomness injected into its construction in the form of mechanisms leading to step functions to enable it to learn simple behaviour patterns. The relationship between random rapid choice (again the time scale is critical) and the ability to adjust internal variables which results in a kind of learning is clearly expounded. There is an important distinction, other than that of complexity, between a system such as a machine which is rigidly planned to fulfil a preconceived function and a system containing sufficient step-functions to be flexible enough to learn how to behave. This section leads on to the definition of "ultra-stability" the quality in a system resulting from the ability of a system to acquire methods of behaviour with some sort of survival value; it behaves as if it had a distaste for instability. Consideration of such systems, and of the neuro-physiology of the cerebral cortex, suggest some fruitful analogies and may lead to real progress.

A surprising variety of fields is drawn on for analogies in the development of the theme of this work, and the author's generalised definitions of a "system" and of "ultra-stability" open up new approaches to old problems. To choose an example which the author might reject:—the entities "God the Father," "a True Believer," "Life," may be regarded as a system, and compared with similar systems in which the human participant is not completely dedicated to God in order to see why the first system has "ultra-stability" which others lack. Throughout the constantly changing variables of "Life" the "True Believer" modifies his patterns of behaviour in such a way as always to preserve the stability of his relationship to "God the Father"; and the flexibility necessary to learn these varying patterns of behaviour results from the spiritual analogue of "randomness" in the individual whose life is free of a pre-conceived plan of a career and who lacks the rigidity of a normal individual with his own purpose. The essential point of the distinction is that the "True Believer" is acting to preserve the relationship, not to ensure individual survival; to such a person Death is an inevitable step in a developing relationship with God, not a disaster to be postponed as long as possible.

Other readers of this most stimulating book will arrive at quite different conclusions, but most people would have their brains thoroughly exercised in following the author along his path.

Ernest van Someren.

The Sky and its Mysteries. By E. Agar Beet. (London : G. Bell & Sons, Ltd.). Pp. 238 + 15 plates and 1 chart. Price 15s.

The publishers describe this as "a first readable book in astronomy." It is popular in the sense that its pages are unadorned by mathematical symbols, but readers without a fair groundwork of physical ideas will find it very hard going. With this proviso it can be described as an admirable introduction to astronomy, covering an unusually wide range in space and in history, from the earth to the spiral nebulae, from Thales and Pythagoras to Bethe and Einstein. It presents a well-balanced view of the whole subject, with particularly good chapters on instruments, positional astronomy, and the solar system. Reference is made when possible to objects which can be observed with binoculars or a small telescope, and the reader is constantly urged to look for himself, in the sky and in the library. The plates, very well chosen and adequately reproduced, range from two photographs from the 200-inch telescope to an amateur's drawing of lunar detail.

In both overall plan and detailed content the book would be difficult to improve, but the manner of presentation seems unfortunate. A reader able to follow the often quite complex argument deserves, and surely expects, a more fluent and less juvenile English style.

G. D. ROBINSON.

NOTICES TO MEMBERS

Conference on Static Electrification

Members are reminded that application for places at the Institute Conference on Static Electrification (Bedford College, London, March 25–27) should be received by February 20. Forms of application may be obtained from the Institute.

Graduateship Examination

The Graduateship Examination will be held on June 22–26, 1953. Applications for admission to the examination should be submitted before December 31, preceding the examination but applications received, with the full fees, before March 1 will be considered. Almost twice the 1952 number of candidates have so far entered for the 1953 examination. Regulations, syllabuses and forms of application may be obtained from the Institute. Copies of the 1952 examination papers are obtainable at three shillings a set.

Bournemouth Convention

A number of enquiries have been received about hotel accommodation for the Bournemouth Convention (May 27–30). Sufficient accommodation to provide members with a choice has already been reserved ; forms for booking will be sent to members with full details of the Convention at the end of February.

Conference on Ionisation Phenomena in Discharges

The Clarendon Laboratory, Oxford, in co-operation with The Institute of Physics, the Physical Society and the British Electrical and Allied Industries Research Association will be holding a conference on "Ionisation phenomena in discharges" from July 18–23 next. The main subjects to be discussed are : the mechanisms of glow discharges, sparks and arcs, electrodeless discharges, Geiger counters, photo-ionisation processes and ionisation by electron collision in gases. There will also be a session reserved for questions of general interest.

There will be visits to laboratories, social meetings and excursions.

Further particulars may be obtained from the Conference Secretary, Dr. G. Francis, A.Inst.P., at the Clarendon Laboratory, Oxford (Telephone : Oxford 57359).

THE REGISTER

ELECTIONS TO MEMBERSHIP

An asterisk (*) indicates transfer from another grade.

Fellows

*Bhattacharya, Girindra Nath, D.Sc., Lecturer in Applied Physics, University of Calcutta.

Lindsay, Duncan Douglas, M.A., Lecturer in Physics, University of Aberdeen.

*Miller, Charles Walter, M.Sc., Section Leader, Metropolitan-Vickers Electrical Co. Ltd., Manchester.

*Richards, George Ronald, B.Sc., Ph.D., Principal Scientific Officer, Ministry of Supply, Aberporth.

*Robinson, Eric, B.Sc., Ph.D., Senior Physicist, English Electric Co. Ltd., Stafford.

*Wilson, Alan Herries, M.A., F.R.S., Director of Research, Courtaulds, Ltd., Coventry.

Associates

*Balchin, John Alan, B.Sc., Assistant Physicist, Leicester Royal Infirmary, Leicester.

Bedford, Arthur Hugh, M.A., Physicist, Chance Bros. Ltd., Smethwick.

Blaha, Friedrich, Dr.rer.Nat., Assistant, University of Vienna, Austria.

Blanchard, Allan Frederick, M.Sc., Physicist, Dunlop Rubber Co., Birmingham.

Burton, Eric John, B.A., Scientific Officer, British Iron and Steel Research Assoc., London.

Clarke, Walter Wilson Hugh, B.Sc., Ph.D., Engineer, British Insulated Callender's Cables Ltd., Nr. Liverpool.

Claxton, John Kenneth, B.A., Physicist, Elliott Bros. Research Laboratories, Borehamwood.

*Durant, Ronald Louis, M.Sc., Experimental Officer, Ministry of Supply, Didcot.

*Gent, Alan Neville, B.Sc., Research Physicist, British Rubber Producers' Research Association, Welwyn Garden City.

*Grant, Alison Marjorie, M.Sc., Research Assistant, University of Melbourne.

Greenacre, James Alan, B.Sc., Lecturer in Physics, Wigan and District Mining and Technical College.

*Hall, Kenneth David, B.Sc., Ph.D., Engineer, Ferranti Ltd., Manchester.

Hirsch, Ernest Hermann, B.Sc., Scientific Officer Defence Research Laboratories, Maribyrnong, Victoria.

Hogwood, Haley Evelyn, B.Sc., Senior Experimental Offieer, Armament Research Establishment, Nottingham.

Hulse, Graham, M.Sc., Research Physicist, Monsanto Chemicals Ltd., Wrexham.

Ingham, Ronald, M.A., Research Consultant, Urwick Orr & Partners, London.

Jackson, Fred, B.Sc., Head of Research Section, Siemens Electric Lamps and Supplies Ltd., Preston.

*Jones, David, M.Sc., Scientific Officer, Admiralty Research Laboratory, Teddington.

*Knapp, Peter Edwin, B.Sc., Assistant Lecturer, Northampton Polytechnic.

Knight, Basil Edward, M.A., Physicist, C.A.V. Ltd., London.
Lempicki, Alexander, B.Sc., Research Physicist, Electronic Tubes Ltd., High Wycombe.
Morley, Walter Myers, B.Sc., Research Physicist, Lever Bros. & Unilever Ltd., Port Sunlight.
*Noakes, James William, B.Sc., Lecturer in Physics, West Ham College of Technology.
*Olsen, Jorgen Lykke, B.A., D.Phil., Forschangs Assistant, Erdgenossische Technische Hochschule, Zurich.
Peplow, Maldwyn Edward, B.Sc., Research Engineer, A. Reyrolle & Co. Ltd., Hebburn.
Pinder, Maurice Bentley, B.Sc., Assistant Lecturer, College of Technology, Leeds.
Postle, Lionel John Raymond, B.Sc., Scientific Officer, Wool Industries Research Association, Leeds.
Roberts, Maldwyn Hugh, B.Sc., Physicist, Brown-Firth Research Labs., Sheffield.
Sharma, Chandra Bhan, M.Sc., D.Phil., Lecturer in Physics, Lucknow University.
Smith, Donald Irving, M.Sc., Physicist, A. E. Reed & Co., Ltd., Maidstone.

Graduates

Adams, Roger William, B.Sc., Acoustical Physicist, J. H. Bean & Co., Leeds.
Arkley, James, B.Sc., Research Engineer, Pametrada Research Station, Wallsend-on-Tyne.
Baird, Kenneth, B.Sc., Student, University of Queensland.
Bradley, Joseph William, B.Sc., Graduate Apprentice, Folland Aircraft Ltd., Hamble.
*Bridge, Harry, B.Sc., Physicist, Pilkington Bros. Ltd., St. Helens.
*Brisbout, Francoise Anne, B.Sc., Student, University of Melbourne.
Byrne, Christopher Ian Cowling, B.A., National Service.
Burke, Maxwell James, B.Sc., Physics Demonstrator, University of Queensland.
Butler, Michael Francis, B.Sc., Technical Assistant, Mullard Radio Valve Co. Ltd., Mitcham.
Carpenter, Eric William, B.Sc., Research Worker, University of Leeds.
Clapham, William Frederick, B.Sc., National Service.
Davies, William Gwylfa, B.Sc., Physicist, British Insulated Callender's Cables Ltd., Leigh.
*Davis, Douglas Gerald, B.Sc., Research Student, University College, London.
*Dennis, John Alan, B.Sc., A.R.C.S., Research Assistant, Borough Polytechnic, London.
*Edwards, Ronald James, B.Sc., Assistant Engineer, De Havilland Propellers Ltd., Hatfield.
Farnell, Eric Bernard, B.Sc., Research Student, University of Leeds.
*Finkelstein, Ludwick, B.Sc., Scientific Technical Officer II, National Coal Board, Middlesex.
Godridge, Arthur Malcolm, B.Sc., Acting Scientific Officer, British Coal Utilisation Research Association, Leatherhead.
*Goodfellow, Thomas Leslie, B.Sc., Research Student, University of Durham.
Green, Ronald, B.Sc., Cadet Geophysicist, Bureau of Mineral Resources, Brisbane.
Harris, Peter Thomas, B.Sc., Physicist, Mullard Radio Valve Co. Ltd., Salfords, Surrey.
Haywood, William Martin, B.Sc., Technical Officer, I.C.I. (Metals) Ltd., Birmingham.
*Hill, Dennis Walter, B.Sc., Research Student, Borough Polytechnic, London.
*Humphreys, Peter, B.Sc., Junior Engineer, Research Laboratories of Fairey Aviation Co. Ltd., Heston.
*Jones, Clive Righton, B.Sc., Postgraduate Research, University College of Swansea.
Lamb, Desmond, B.Sc., Student, University of Queensland.
Lee, John Gwyn William, B.Sc., Physicist, De Havilland Propellers Ltd., Hatfield.
Leader, Arthur Charles, B.Sc., National Service.
*Lucken, Jack Augustus, B.Sc., Research Engineer, E.M.I. Research Laboratories Ltd., Hayes.
Major, Ronald Charles, B.Sc., Assistant, De Havilland Aircraft Co. Ltd., Edgware.
Marshall, Joseph, B.Sc., Development Engineer, Elliott Bros. Ltd., Herts.
Mathewson, Donald Seaforth, B.Sc., Scientific Assistant, University of Queensland.
Middleton, Warren Cedric, B.Sc., Research Student and Demonstrator, University of Queensland.
*Millwood, Cyril James Clifford, B.Sc., Technical Assistant, Dubilier Condenser Co. (1925) Ltd., London.
Mitchell, James Ian, M.Sc., Assistant Teacher, Acton Technical College, London.
*Murray, Cyril Thomas, B.Sc., B.E., Lecturer in Electrical Engineering, University of Sydney.
*Possener, Michael, B.Sc., Research Student, University of Manchester.
Poultney, Alan Eusebius John, B.Sc., National Service.
*Pringle, Kenneth, B.Sc., Instrument Engineer, Bataafsche Petroleum Maatschappij, The Hague.
Read, William John, B.Sc., National Service.
*Richards, Harold John, B.Sc., Physicist, Mullard Radio Valve Co. Ltd., Salfords, Surrey.
Robinson, Norman, B.Sc., Assistant Lecturer, Spring Grove Polytechnic, London.
Ross, Robert Ian, B.Sc., National Service.
Sbresni, Raymond Colin, B.Sc., Demonstrator, University of Queensland.
Seymour, John, B.Sc., Valve Project Engineer, Standard Telephones and Cables Ltd., Footscray.
*Shachter, Israel, B.Sc., Scientific Staff, General Electric Co. Ltd., Wembley.
Starford, Geoffrey, B.Sc., Assistant Lecturer in Physics, College of Technology, Liverpool.
Stevens, Keith Allan, B.Sc., Junior Physicist, University of Queensland.
*Strahle, David George, B.Sc., Scientific Officer, Department of Supply, Australian Commonwealth Government.
*Street, Leonard Kindell, B.Sc., Research Assistant, Birkbeck College, London.
Taylor, Richard Gibson, B.Sc., Junior Physicist, University of Queensland.
*Thompson, Anthony Richard, B.Sc., Research Student, University of Manchester.
Walker, Norman Alan, B.Sc., Demonstrator in Physics, University of Queensland.
Walmsley, Bruno Joseph, B.Sc., National Service.
Walton, Stephen, B.Sc., Experimental Staff, General Electric Co. Ltd., Wembley.
Wright, Kenneth, B.Sc., Technical Assistant, Osram, General Electric Co. Ltd., London.
Yates, Bernard, B.Sc., Research Student, University of Leeds.
Yates, William Albert, B.Sc., Assistant Experimental Officer, Services Electronics Research Laboratory, Baldock.
*Young, Ronald, B.Sc., Research Physicist, J. A. Jobling & Co. Ltd., Sunderland.

Subscribers

Beaven, Gilbert Henry, Research Chemist, The London Hospital.
Mason, George Leslie, Spectrographer, United Steel Co. Ltd., Sheffield.
Paine, Peter Alvin, Metallurgist's Assistant, Railway Executive Metallurgical Lab., Ashford.
Stein, Stephen, Company Director, Panta Instruments Ltd., London.

Students

Absalom, R. M., Schools of Technology, Art and Commerce, Oxford.
Allan, K. M., University of Birmingham.
Awadalla, A. M. M., Chelsea Polytechnic.
Ball, D. J., Sir John Cass College, London.
Benjamin, P., Royal Technical College, Glasgow.
Bennett, J. E., University of Southampton.
Bold, J. C., College of Technology, Liverpool.
Boyce, I. S., Loughborough College.
Campbell, A., University of Edinburgh.
Chance, J. P., The Polytechnic, Regent Street, London.
Charsley, P., University of Bristol.
Collins, R., Royal Technical College, Salford.
Coppen, P. J., University of Bristol.
Coughlin, B. J., The Polytechnic, Regent Street.
Davies, M. A., University College of Wales, Aberystwyth.
Davies, S. M., King's College, London.
Dodsworth, G. E., Queen Mary College, University of London.
Eastlake, R. P., South East Essex Technical College, Dagenham.
Fordham, R. F., Northern Polytechnic, London.
Gale, N. H., Imperial College of Science and Technology, London.
Grimes, N. W., University of Bristol.
Hansford, I. V., University of Bristol.
Hathaway, J. M., Royal College of Science, London.
Hill, R. M., Royal Technical College, Glasgow.
Holmes, E. L., University of Bristol.
Hood, J. W., University of Manchester.
Hope, C. S., Royal Technical College, Glasgow.
Howie, R., Royal Technical College, Glasgow.
Ingram, M. J., South East Essex Technical College, Dagenham.
Johnston, J. S., Royal College of Science, London.
Knight, A. Y., South East Essex Technical College, Dagenham.
Kosky, J., Imperial College of Science and Technology, London.
Lang, A. B., Sunderland Technical College.
Lewinsohn, L. J., The Polytechnic, Regent Street.
Lewis, A. J., South East Essex Technical College, Dagenham.
Lewis, I. R. L., Woolwich Polytechnic, London.
Livingston, L. D., College of Technology, Liverpool.
Marjoram, J. R., South East Essex Technical College, Dagenham.
Marshall, G. F., South East Essex Technical College, Dagenham.
McInnes, A. A., Royal Technical College, Glasgow.
Miller, R., Royal Technical College, Glasgow.
Mussett, E. A., Imperial College of Science and Technology, London.
Nicol, A. A., Royal Technical College, Glasgow.
Packham, D. G., The Polytechnic, Regent Street.
Patterson, H., Royal Technical College, Glasgow.
Penny, R. W., University of Southampton.
Petrie, J. L., King's College, London.
Pigg, R., University of Durham.
Pomeroy, C. D., Research Officer, British Leather Manufacturers' Research Association.
Rayment, J. E., Royal Technical College, Glasgow.
Ridley, H., University of Durham.
Roberts, J., University College of Wales.
Robertson, G., Royal Technical College, Glasgow.
Rogers, E. C., University of Bristol.
Shavick, L., Imperial College, London.
Shotter, B. A., Northampton Polytechnic, London.
Smith, S. M. J., Royal Technical College, Glasgow.
Spiers, V. M., University of Birmingham.
Stillwell, J. C., Technical College, Derby.
Thompson, B. J., University of Manchester.
Watson, H. C., University of Manchester.
Walters, G. D., Glamorgan Technical College, Treforest.
Warden, M. P., Cardiff University College.
Wilkinson, D., College of Science and Technology, Oxford.
Williams, M., University of Leeds.
Youngs, E. G., King's College, University of London.

Addresses Wanted

The present addresses or information concerning the whereabouts of the following are required for the Institute's Register. Their last known locations are given in brackets.

Associates

Bathija, Prof. M. C. (Sindh, India).
Boohariwalla, D. B. (Rajkot, India).
Wilson, P. B. (London).

Subscribers

Caldwell, J. T. (Melbourne, Australia).
Gillett, B. A. (London).

APPOINTMENTS VACANT

The inclusion of particulars of a vacancy must not be taken to imply that the Institute necessarily approves of the terms offered or that might be offered. Candidates should satisfy themselves that these are satisfactory, and they may always refer to the Institute for advice.

SCIENTISTS

Graduate Physicist required with knowledge of the operation of Arc Spectrographic and X-Ray diffraction equipment. Work relates to the development and improvement of abrasives and allied products. Age 20–30. Apply: Personnel Manager, **Universal Grinding Wheel Co. Ltd.**, Stafford.

Opportunity occurs for young **physicist** with 1st or 2nd class honours and interest in practical electronics and more theoretical aspects of physics, to work on a project the results of which will be available for use as a higher degree thesis. Apply to Dr. A. D. Booth, Director, **Birkbeck College** Electronic Computer Project, 21 Torrington Square, London, W.C.1.

Applications are invited for the post of **Senior Lecturer** in charge of the electronics work of the Department of Electrical Engineering, including undergraduate and postgraduate courses, and research.

Applicants must have had considerable experience in electronics and research and preferably some teaching experience. Salary scale £1,150 × £50 — £1,450.

Particulars of the appointment and forms of application may be obtained from the Secretary, **Royal Technical College,** George Street, Glasgow.

Physics Graduate required for research in the strength of paper and board. Initial salary within range £400 — £650, and F.S.S.U. Further particulars and application form on request from **The Printing, Packaging and Allied Trades Research Association,** Randalls Road, Leatherhead, Surrey.

Physicist interested in mechanics required for study and instrumentation of felting machines. Experience will be given in the design of factory experiments and the application of statistical methods. Candidates should possess an Honours degree or equivalent and be between 21-26 years. The salary will be on the scale £425 × 25 — £650 p.a., with superannuation under F.S.S.U. Consideration will, however, be given to any special experience or training.

Applications to the Director, **The British Hat and Allied Feltmakers Research Association,** Stanley House, Manchester Road, Fairfield, Droylsden, Manchester.

Western Infirmary of Glasgow. Applications are invited for the appointment of **Assistant Physicist** to the Western Infirmary of Glasgow. The appointment will initially be made in the Senior Grade of the Whitley Council Scale (£800 × £40 — £1,080), with placing according to experience and qualifications. There is a possibility of promotion to the Principal Grade (£1,125 × £50 — £1,375) within the next two years.

The successful candidate will work, under the direction of the Regional Physicist, in the Western Infirmary and associated hospitals. In addition to the usual routine duties in the Radiotherapy Department the work will include (*a*) teaching of physics, apparatus construction and cognate subjects for the M.S.R. examinations and for the radiological diplomas ; (*b*) co-operation with clinical teams in the use of radioactive isotopes.

Candidates should preferably have a higher degree in physics and some experience of hospital work.

Applications stating age, qualifications and present appointment, and giving the names of three referees, should be submitted to the Secretary, Board of Management for Glasgow Western Hospitals, 10 Park Circus, Glasgow, C.3.

The British Cast Iron Research Association has a vacancy on its research staff for an **investigator** for the determination of solidification sequences in cast iron by temperature gradient measurements as part of an investigation on the soundness of iron castings. Applicants should possess an honours degree or its equivalent, and some previous research and/or industrial experience would be an advantage. The appointment will be in the Scientific Officer (£418 — £676 per annum) or Senior Scientific Officer (£785 — £890 per annum) grade according to age, experience and qualifications. Applicants should submit full details of qualifications, age and experience to the British Cast Iron Research Association, Alvechurch, Birmingham.

Nelson Research Laboratories, **English Electric Co. Ltd.,** have a vacancy for a **Senior Physicist** for work on magnetic materials, chiefly in connection with the application of the latest ideas to soft ferromagnetics. Applicants should have a good Honours Degree and have at least four years' industrial or academic research experience. This is a most interesting vacancy in this field, and offers scope for advancement. Please reply to Central Personnel Services, English Electric Company Limited, 336/7 Strand, London, W.C.2, quoting Ref. 1079.

University of Otago, Dunedin, New Zealand. The University proposes to appoint a **Senior Lecturer** or **Lecturer** in Physics.

The salary range is for a Senior Lecturer, £1,000 × £50 — £1,200 per annum, and for a Lecturer £800 × £50 — £950 per annum.

Further particulars and information as to the method of application should be obtained from the Secretary, Association of Universities of the British Commonwealth, 5 Gordon Square, London, W.C.1.

The closing date for the receipt of applications in London and New Zealand is 15th March, 1953.

Research Manager. A large electrical manufacturing company in the South Midlands requires a physicist experienced in the administration of research, to co-ordinate its research programme. The appointment is a new one and the successful applicant will be responsible for controlling and co-ordinating a number of projects which at present are separately administered. He will be responsible for the preparation and administration of a substantial budget. An attractive salary will be paid to the right man. Reply to Box No. A.V.32, The Institute of Physics, 47 Belgrave Square, S.W.1.

Senior Scientific Officer required at Capenhurst, Chester, for analytical and vacuum technique development and work involving mass transfer in polyphase systems. Minimum qualifications : age 26, 2nd class honours degree in physics (or equivalent) and two years experience in one type of work mentioned. F.S.S.U. may be applicable. Salary £781 — £980. Applications to **Ministry of Supply,** Division of Atomic Energy (Production), Risley, Warrington, quoting reference 410.

Applications are invited for the post of Full-time **Lecturer** in the Physics Department of the **Northampton Polytechnic,** St. John Street, E.C.1. Salary £900 × £25 — £1,000, plus the London Allowance and a cost of living bonus of £40. Candidates should have a good Honours Degree with some teaching or industrial experience, and preference will be given to those with a special interest in Electronics or Electro-Acoustics. Applications should be sent to the Principal, Dr. J. E. Richardson.

ASSISTANT

University of Natal, Pietermaritzburg, South Africa, invite applications for the post of **Laboratory Steward** in the Department of Physics, with a salary scale of £450 × £25 — £550 per annum. In addition a cost of living allowance of £320 p.a. for married men and £100 p.a. for single men is paid at present. A Government Commission is enquiring into salary scales and it is hoped that improvements may be effected during the present year.

Further particulars and information as to the method of application should be obtained from the Secretary, Association of Universities of the British Commonwealth, 5 Gordon Square, W.C.1.

The closing date for the receipt of applications, in London and South Africa, is March 31, 1953.

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